

# **Developing a Map of U.S. Army Corps of Engineers Projects with Municipal and Industrial and Irrigation Water Supply Storage**

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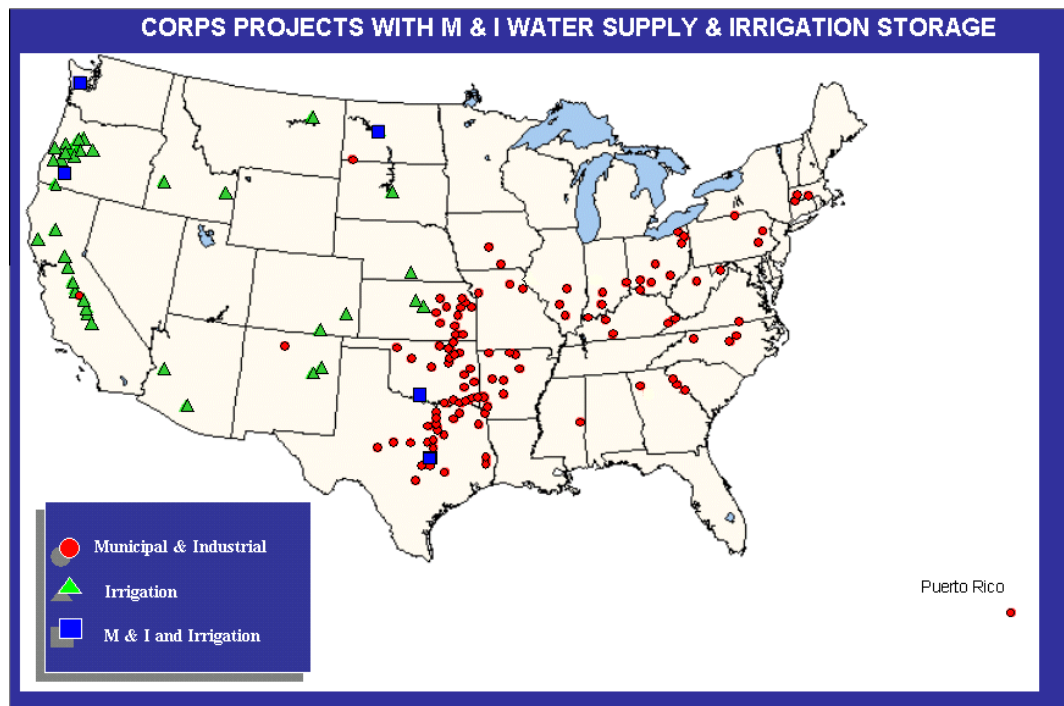
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## PREFACE AND ACKNOWLEDGEMENTS

This report was produced as part of the fiscal year 2003 Policy Studies Programs, a corporative effort between the Civil Works Directorate, Headquarters U. S. Army Corps of Engineers and the U.S. Army Corps of Engineers Institute for Water Resources. Monica A. Franklin of the Planning and Policy Studies Division of the Institute for Water Resources developed the program presented in this report under the supervision of Theodore M. Hillyer. Chief of the Planning and Policy Studies Division is Eugene Z. Stakhiv. At the time of the development of this report, the Acting Chiefs of the Planning and Policy Studies Division were Lynn R. Martin and Robert W. Brumbaugh. The Director of the Institute for Water Resources is Robert A Pietrowsky.

This particular study is included in the funding provided under the umbrella of the Comprehensive Water Supply Study Part III. The Comprehensive Water Supply Study supports the Municipal and Industrial (M&I) water supply mission of the Corps of Engineers. During this Comprehensive Water Supply Study, it became obvious that the available data on both M&I as well as irrigation storage should be made available to Corps employees and the general public on an easy to access web site. This has been accomplished by development of a map with the locations of all of the Corps M&I water supply and irrigation projects. This map of the United States locates the exact site of each of the Corps' M&I and irrigation water supply projects by longitude and latitude. All that is needed is to click on the dot of the location of project you are interested in to find: the state, project name, Corps district, number of contracts, storage space allocated to the purpose and associated costs. This report lays out and describes in detail how this process was developed.

The author wishes to thank Mr. Hillyer for his input to and oversight of the development of the water supply map and this ensuing report and to Aida Ibisevic for her editorial comments. Douglas H. Lee of the Planning and Policy Studies Division of the Institute for Water Resources also provided valuable assistance in the development of this program. The data on M&I water supply and irrigation projects in this document were obtained from the *Water Supply Handbook*, IWR Report 96-PS-4, revised December 1998.

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## **Purpose:**

To capture the technology employed to prepare a graphic map that has hot links embedded in it to display additional information. The technology used in the development of the map has wide application to all Corps business lines.

## **Goal:**

To provide a user-friendly and interactive map in which users can locate and access information about Corps projects with water supply and irrigation storage.

## **Software Used:**

ArcView 3.2 (a software tool for desktop GIS and mapping)

MS Excel

Digital Project Notebook (<http://crunch.tec.army.mil/dpn/webpages/dpn.cfm>)

**Process:** The procedure followed to develop the map was basically a five-step process.

1. First, a Microsoft Word document of the projects was obtained. This data was based on the database of the *Water Supply Handbook*, IWR Report 96-PS-4, revised December 1998. <http://www.iwr.usace.army.mil/iwr/pdf/96ps4.pdf> This list of projects was used to look up the latitude and longitude coordinates for each project using the Digital Project Notebook.\*
2. The next step was to create a shapefile for each type of project to overlay on an existing shapefile of the United States provided by the ArcView software. A shapefile is a file format in which ArcView can read and display spatial data. Behind each shapefile are the attributes or data that describe the shapefile. These attributes are used as a guideline for which ArcView should display that data. For this project, the latitude and longitude

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\*When entering the Civil Works Project Notebook website, click on the Introduction button to be directed to the search engine for querying Civil Works projects.

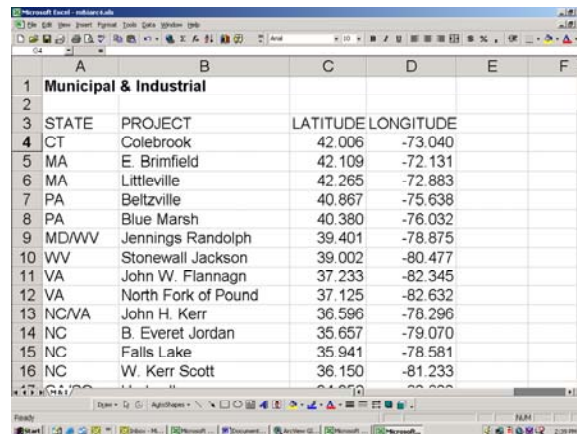
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attributes are used to plot the projects. The three types of projects are: Municipal & Industrial, Irrigation, and projects containing both. Each of these types must have their own shapefile to distinguish each type of project on the map. Each project type is given a symbol to represent itself on the map.

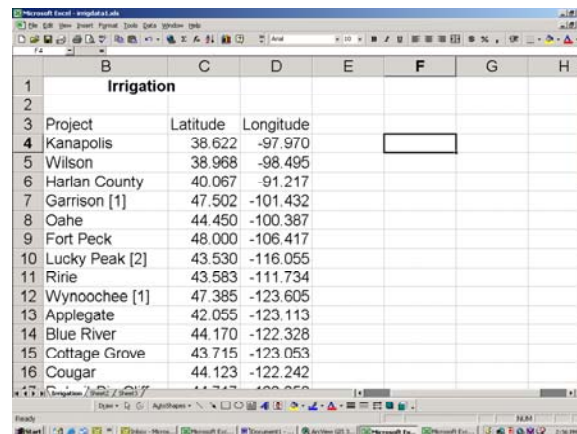
To create the three shapefiles, first make a table in Excel and then transport the table to ArcView. Each table contains four elements of information: **State, Project Name, Latitude, and Longitude**. Save the table in a dBASE IV file format (.dbf) instead of a spreadsheet. The reason for doing so, is that ArcView can only read tabular data in this file format.



A screenshot of a Microsoft Excel spreadsheet titled 'municipal.xls'. The spreadsheet contains a table with 4 columns: STATE, PROJECT, LATITUDE, and LONGITUDE. The data is organized into rows, with the first row labeled 'Municipal & Industrial'. The data includes projects from various states including CT, MA, PA, MD/VA, WV, VA, NC/VA, NC, and NC.

STATE	PROJECT	LATITUDE	LONGITUDE
CT	Colebrook	42.006	-73.040
MA	E. Brimfield	42.109	-72.131
MA	Littleville	42.265	-72.883
PA	Beltzville	40.867	-75.638
PA	Blue Marsh	40.380	-76.032
MD/VA	Jennings Randolph	39.401	-78.875
WV	Stonewall Jackson	39.002	-80.477
VA	John W. Flannagn	37.233	-82.345
VA	North Fork of Pound	37.125	-82.632
NC/VA	John H. Kerr	36.596	-78.296
NC	B. Everet Jordan	35.657	-79.070
NC	Falls Lake	35.941	-78.581
NC	W. Kerr Scott	36.150	-81.233

Table 1: *Municipal & Industrial*



A screenshot of a Microsoft Excel spreadsheet titled 'irrigation.xls'. The spreadsheet contains a table with 4 columns: Project, Latitude, and Longitude. The data is organized into rows, with the first row labeled 'Irrigation'. The data includes projects from various states including Kanapolis, Wilson, Harlan County, Garrison [1], Oahe, Fort Peck, Lucky Peak [2], Rinie, Wynoochee [1], Applegate, Blue River, Cottage Grove, and Cougar.

Project	Latitude	Longitude
Kanapolis	38.622	-97.970
Wilson	38.968	-98.495
Harlan County	40.067	-91.217
Garrison [1]	47.502	-101.432
Oahe	44.450	-100.387
Fort Peck	48.000	-106.417
Lucky Peak [2]	43.530	-116.055
Rinie	43.583	-111.734
Wynoochee [1]	47.385	-123.605
Applegate	42.055	-123.113
Blue River	44.170	-122.328
Cottage Grove	43.715	-123.053
Cougar	44.123	-122.242

Table 2: *Irrigation*

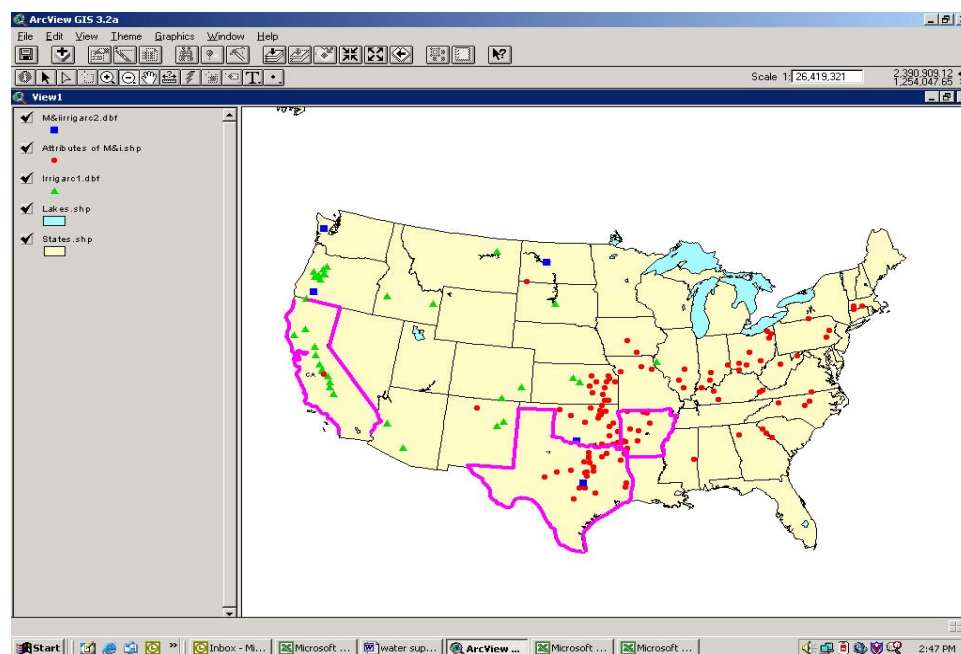




	A	B	C	D	E	F	G
1							
2		<b>M &amp; I and Irrigation</b>					
3	State	Project	Latitude	Longitude			
4	ND	Garrison	47.502	-101.432			
5	WA	Wynoochee	47.385	-123.605			
6	TX	Belton	31.100	-97.483			
7	OK	Waurika	34.235	-98.055			
8							
9							
10							
11							
12							
13							
14							
15							
16							

**Table 3: M&I and Irrigation**

- Using ArcView, each table was imported to create three shapefiles (one for each type of project). ArcView was also used to plot each project on the map according to its geographic coordinates. To import the tables, they must first be saved in a dBASE IV format, as mentioned before, so that ArcView can read it. To open them in ArcView, choose Add Table from the Project menu, and choose those dBASE files that were just saved in Excel. ArcView will convert them to shapefiles so they can be displayed on the map.



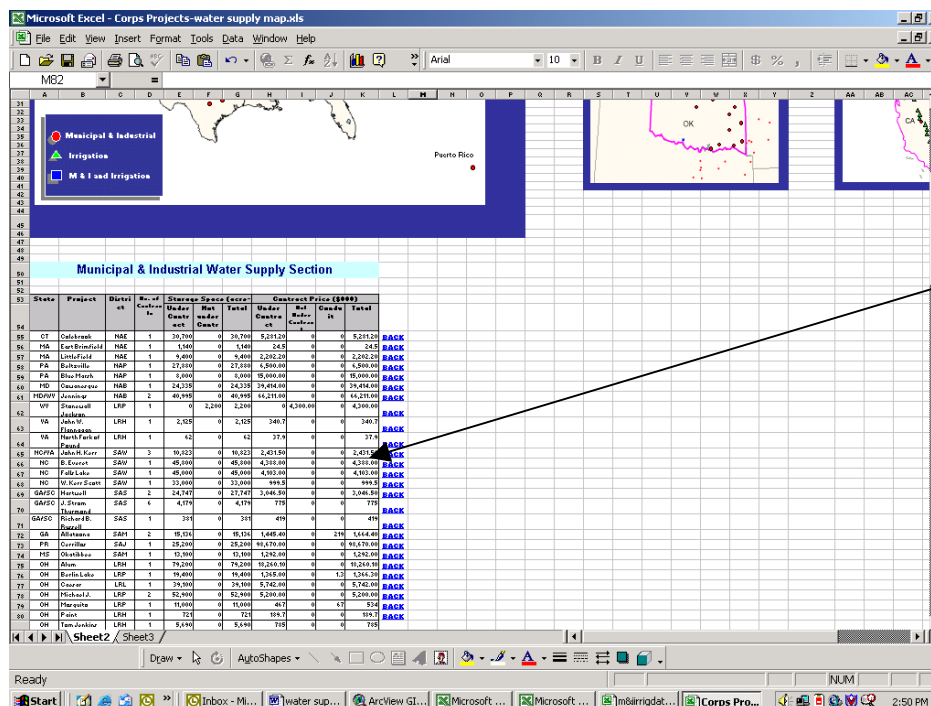
**Figure 1: The original map created in ArcView to be imported into Excel**

- The next step was to export the map created in ArcView, with all the projects plotted, as a JPEG image back into a new spreadsheet in Excel. ArcView has the capability to capture and save any view/display as an image to be used in another application. Using this image as a guide, circles, squares, and triangles were drawn on top of the ones

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embedded in the image, within Excel. This was done to accomplish the linking of the data. This was probably the longest step in the process because each dot, square, or triangle must be placed directly on top to hide the embedded ones.

5. The final step in the process was to copy the project information from the original table created in MS Word (from Step 1), and paste it below the map in Excel. This was done to give each piece of information its own cell location for linking. Each dot, triangle, and square is given a hyperlink by right clicking and selecting “hyperlink.” In the hyperlink box, the cell location of the corresponding information is typed in to link them [the dot, circle, or triangle and the information associated with it].



Original project  
data is copied and  
pasted here.

**Figure 2:** *The final product after the table is added.*

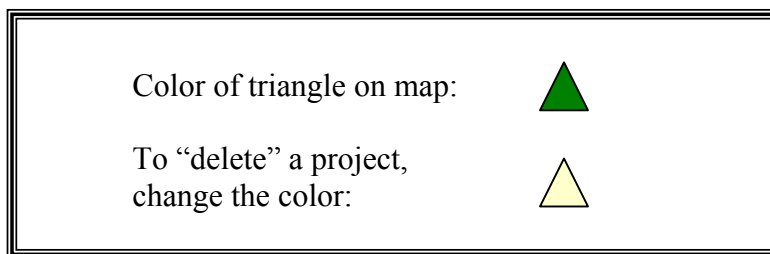
Once the map is completed, a user can click on a project on the map and be directly linked to the information associated with that particular project. Excel highlights the information for the project selected.



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**Figure 4:** *“Deleting” a project*



3. Adding a project is a relatively simple procedure. The only step is to duplicate the appropriate feature (dot, triangle, or square) by MS Excel and add it to the map. An approximation of the location of the project can be obtained by use of the Digital Project Notebook. The problem in this step is that the location of the project is only an approximation because MS Excel cannot plot the point as accurately as ArcView.

### **Map Site:**

The water supply map can be found on the Institute for Water Resources homepage at: <http://www.iwr.usace.army.mil/>. At this location, click on “Specialties.” On the Specialties screen click on “Water Use.” Go to the bottom of the Water Use page and click on “Corps Water Supply and Irrigation Map.” Depending on the computer, it may be necessary to right click and “Save Target As....”

### **Data Summary:**

The data shows for municipal and industrial water supply there are 237 contracts in 117 projects in 24 states plus Puerto Rico in 22 of our districts. Total storage space is over 9.5 million-acre feet and the reimbursable cost is just over \$1.3 billion. For irrigation water supply, there are 40 projects in 14 states in 9 of our districts. Total storage is almost 53 million-acre feet, but most all of that is joint use with other purposes. Total Federal investment is just under \$1.3 billion. Five of the projects contain storage for both municipal and industrial as well as irrigation water.

